Fig. 3. *Araneus Woodfordi*, sp. n. Dorsal surface of cephalothorax and abdomen.
Fig. 3 *a*. Ditto. Vulva.
Fig. 4. *Pasilobus mammatus*, sp. n. Dorsal view.
Fig. 5. *Actinacantha metallica*, sp. n. Dorsal view.
Fig. 6. *Gasteracantha signifer*, sp. n. Dorsal view.
Fig. 7. *Dolomedes laticeps*, sp. n. Right palpal organ from below.
Fig. 8. *Palystes speciosus*, sp. n. Vulva.
Fig. 8 *a*. Ditto. Right palpal organ from below.
Figs. 9, 9 *a*. *Heteropoda* (*Parhedrus*) *mecistopus*, sp. n. Right palpal organ from below.
Fig. 10. *Bathippus macroprotopus*, sp. n. Dorsal view.
Fig. 11. *Eustirognathus oscitans*, gen. et sp. n. Anterior view of head and mandibles.
Fig. 11 *a*. Ditto. Side view of carapace.
Fig. 11 *b*. Ditto. Labium and maxillæ.

BIBLIOGRAPHICAL NOTICE.

Fossil Plants: for Students of Botany and Geology. By A. C. Seward, M.A., F.G.S., &c. Vol. I. With Frontispiece and 111 other Illustrations. Pages xviii and 452. 8vo. University Press, Cambridge. 1898.

This volume is one of the Biological series of the Cambridge Natural Science Manuals. The mutual bearings of Geology and Botany are well considered by the author in his preface, and clearly elucidated throughout his work. He intimates, with good reason, that both of these branches of science are rarely sufficiently well understood by one and the same naturalist; for a botanist will probably with ease get enough knowledge of geology, without working its deeper and more complicated problems, to be assured of its value in palæobotany; whilst, on the other hand, a geologist, taking up the subject intently, would require an intimate knowledge of the advanced and manifold researches of recent botany. In the third place, students having a general knowledge of natural science can find interest and instruction in such an earnest, clear, and comprehensive exposition of the principles and facts concerning petrified plants as this manual now before us.

The difficulty of clearing away the physical obscurities from fossil plant-remains, due to their imbedment, mineralization, and imperfections, doubtlessly delayed botanists from attempting to co-relate them with living forms to any great extent; and when they knew of the relative age and successional occurrence of these fossils, they could not feel sufficient interest to study their geological history in detail. Fossil-collectors, applying a limited knowledge of recent plants to the desired explanation of fossil leaves, fruits, and wood, made very slow advance; but they obtained some good results with careful use of the hand-lens. With the compound microscope, however, and the acquired art of making more or less transparent

slices of both fossil and recent specimens, sound knowledge accumulated from many sources. Under these circumstances both botanist and geologist were interested in the research; and one result arrived at was that the fossil plants, in many instances, could not be closely classified with those now known to be living, and were therefore assorted into other typical species and groups, with distinctive names. This was especially the case with several kinds of trees found fossil in the Coal-measures. Among British and foreign palæobotanists the late W. C. Williamson stands pre-eminent in his bold and successful exposition of the structural characters and biological affinities of these Carboniferous plant-remains. As a life-long geologist and experienced professor of botany Dr. Williamson combined all the requirements of a palæobotanist. There are others working on the same lines, and one of the most promising, and, indeed, successful, among them is the author of the book under notice.

In Part I. there are six chapters treating generally of the historical and geological aspects of the subject. Chapter I. sketches the ideas of the older observers, and the successful results of modern research. In Chapter II. the author considers the mutual bearings of botany and geology in a philosophic spirit, carefully and comprehensively, with the earnestness of personal knowledge. Chapter III. takes up the geological history, or broad features of the successive stages in the building of the earth's crust, and gives a condensed but clear account of the natural origin of conglomerates, sandstones, shales, and limestones, also of the superposition of strata with or without successional organic remains; there are also allusions to rock-foldings and dislocations, to metamorphism and igneous rocks. After a careful and suggestive "Table of Strata," the different formations are successively taken in hand, and their main characteristics briefly described (pp. 32–53). The continuous evolution of the earth's constitution is insisted on as proved by the details of its history. Chapter IV. (pp. 54–92) gives an excellent account of the preservation of plants as fossils under very different circumstances and in manifold conditions. First on surface-soils, both now-a-days and in far-past ages; for the frontispiece illustrates the stumps of a forest of Carboniferous age, now exposed near Glasgow, and the analogous fig. 5 (occupying page 59) shows the relics of a submerged forest of recent date on the coast of Cheshire. The local accumulation of plant-remains of all sorts and sizes in the great rivers of India, America, and Western Africa illustrates the origin of vast quantities of vegetable remains, often of different characters, in some strata. The peculiar local association of plants and animals, of various families and orders, both aquatic and terrestrial, in the Bowera Creek (p. 66) is, of course, noticed as an important example to be studied by palæobotanists. The conditions in which fossil plants occur, whether more or less altered and imperfect, and their stony or mineral constituents, their relative positions, and modes of imbedment, are next studied in considerable detail. Chapter V. treats of the difficulties and the sources of error

in the determination of fossil plants. External resemblances may easily deceive the inexperienced student, as shown by examples in figs. 20, 21, and 22. The venation characters are often doubtful as tests in family or generic affinity, and even for larger groups, as classes. Decorticated or otherwise imperfect casts of stems present difficulties, some of which receive interesting explanations at pages 102–105. Thus, the bark of one species of *Lepidodendron* is stated to have been described with twenty-eight specific names, under several genera. *Lyginodendron*, *Artisia*, *Sternbergia*, and *Tylodendron* have been referred to mere peculiarities of structure represented by casts. Contemporary insects, boring holes in plants before they were fossilized, have left their minute coprolites in abundance, easily mistaken for spores of cryptogams.

Some cautious, sound, well-timed, and therefore useful remarks on nomenclature and terminology, for the advantage of neophytes and others, close this chapter and Part I. of the book.

Part II. of this volume is occupied by descriptions of the plants constituting the lower divisions of the Vegetable Kingdom and the geological conditions under which they are met with. They are taken in their natural sequence, beginning with the lowest.

The Thallophyta (pp. 116–228) supply:—I. The Peridiniales, represented by *Peridinium pyrophorum*, Ehrenberg: II. The Coccospheres and Rhabdospheres, so common in the Chalk as well as in the ocean, are described as organisms of doubtful affinity, but probably algal (p. 121); III. The Schizophyta comprise (1) the Schizophyceæ (Cyanophyceæ) and (2) the Schizomycetes. The former are "fission-plants" or "blue-green algæ," and the latter are "fission-fungi." 1. The formation of many calcareous oolitic concretions is intimately connected with the presence of Chroococcaceæ and Nostocaceæ, members of the Schizophyceæ; and probably the *Girvanella*, a simple tubular organism to which oolites in several rocks are attributed, as also the *Zonatrichites*, may belong to this group. The building-up of both calcareous and siliceous sinters is regarded by some as due to the presence of some such low-class, filamentous, and gelatinous algæ. There are also minute boring algæ belonging to this group, which perforate and burrow in corals, molluscan shells, and fish-scales; and their analogues are found fossil. Besides helping to reduce these hard substances to debris, and, on the contrary, building up calcareous rocks, Cyanophyceæ have been probably efficient agents in preparing the mass of hot volcanic ashes in the island Krakatoa for the growth of highly organized plants, by occupying and modifying the surface under conditions which would be fatal to more complex types.

2. The Bacteria belong to Schizomycetes; and a most careful and cautious account of the researches that have led to the specification of Micrococcus and Bacillus, as well in the fossil remnants of plants that have suffered decomposition, as in coprolites of fish and reptiles (pp. 132–138), deserves attentive consideration. The possible error of mistaking spherical particles and rod-like bodies due to incipient crystals in calcareous and siliceous mineralization

is properly indicated, without throwing total discredit on the researches of earnest and conscientious observers.

IV. Algæ succeed, and the impossibility of accepting very many of the so-called fucoids, or fossils referred to seaweeds, is reasonably insisted on. Other members, however, of the algal group are abundant both in recent and fossil states. The Diatomaceæ (Bacillariaceæ) are succinctly described as belonging to the "Brown Algæ," and their wide distribution in existing waters, both fresh and salt, is analogous to their frequent occurrence, sometimes in enormously thick deposits, in the later geological formations. The oldest known fossil form has been found in the Lias: other forms are common in the Chalk; and others are vastly numerous in some Tertiary formations. For reasons given, the reported occurrence of diatoms in the Coal and in the Trias is not accepted.

The Chlorophyceæ, or "Green Algæ," comprise the Siphoneæ and Confervoideæ. Of the former, *Caulerpa* is a recent representative, and two fossils have been referred to it; but the Silurian *Caulerpites cactoides*, Göpp., is rejected, and the Jurassic *Caulerpa* [*ites*] *Carruthersi*, Murray, not accepted by the author. *Codium* and *Penicillus* come in the same category; the former has a doubtful fossil analogue (*Sphærocodium*), a limestone-maker of Triassic age. The author thinks that *Girvanella*, Bornemann's *Siphonema*, and *Sphærocodium* are closely allied and probably algal, but too imperfectly known to be referred to any particular family.

Penicillus has ten recent, mostly tropical, species; but in the fossil state there are many allied forms. These have mostly been described as foraminiferal, but have now been brought home to the Siphoneæ by Prof. Munier-Chalmas. Of these reclaimed organisms the chief are *Acicularia*, *Polytrypa*, *Vermiporella* and others (Silurian), *Sycidium* (Devonian), *Diplopora* and *Gyroporella* (Triassic), *Dactylopora* (Eocene), and others, belonging to Munier-Chalmas's Siphoneæ Verticillatæ, of which *Acetabularia* and *Cymopolia* are good recent types.

For the Confervoideæ several so-called Confervites have been recorded by geologists, but scarcely any of them are of value. At pages 178–183 "Torbanite" or "Boghead Coal" is discussed. It consists of minute light brown granules of hydrocarbon, with some earthy matter, and portions of the tissues of coal-plants. In the morsels of hydrocarbon in Torbanite and Kerosene-shale (known also as Tasmanite) MM. Renault and Bertrand see evidence of some Chlorophyceous? Algæ, which they name *Pila* and *Reinschia*. The author seems to go with this opinion to some extent. It is noticeable, however, that the *Reinschia* represented by fig. 3 at page 180, although its hydrocarbon is somewhat modified, has much resemblance to a compressed macrospore, such as abound in Tasmanite. The important paper by Mr. E. T. Newton in the Geol. Mag. 1875, has escaped the author's notice.

Of the "Red Algæ" group, the Nullipores (Melobesieæ and Corallineæ) comprise very important rock-builders in both recent

and past time. The " Brown Algæ " include the common *Fucus* or *Chondrus*, the gigantic *Lessonia*, and the floating *Sargassum*. A colossal fossil form (*Nematophycus*) is regarded (pages 192–202) as a doubtful member of this group; it is from Silurian and Devonian strata; and so is *Pachytheca*, possibly the sporangium of the same or an allied alga.

Of the very low-class Myxomycetes some possible representatives in the fossil state are referred to (p. 205). Fungi (pp. 207–222), chiefly parasitic on leaves and in the tissue of plants, from the Carboniferous period upwards, are not unfrequent. The Charophyta are well represented by *Nitella* and *Chara*, the latter in both recent and fossil state.

In Chapter VIII. the Liverworts occur fossil as *Marchantites*; and the Mosses as *Muscites*, one in the Coal-measures. In Chapters IX.–XI. the " Vascular Cryptogams " are described, with their fossil predecessors, so important in geological history. These Pteridophyta comprise :—(i.) Equisetales; (ii.) Sphenophyllales; (iii.) Lycopodiales; (iv.) Filicales. The external character and internal structure of the recent *Equisetum* are carefully described (pp. 244–254), and then the fossil forms—(1) *Equisetites*; (2) *Phyllotheca*; (3) *Schizoneura*; (4) *Calamites*; and (5) *Archæocalamites*—are described in detail, with remarks on their relationships, geological position, and distribution. The *Calamites* (pp. 295–388) are more fully described than the others, with their bibliographic history, the description of the anatomy of their stems (*Arthropitys*, *Arthrodendron*, *Calamodendron*), their leaves (*Calamocladus* or *Asterophyllites* and *Annularia*), their roots, and their cones (*Calamostachys*, *Palæostachya*, and *Macrostachya*), also the pith-casts of *Calamites*, *Calamitina*, *Stylocalamites*, and *Eucalamites* (pp. 367–379). A useful tabular summary of the different generic and subgeneric terms used by the author in this excellent account of *Calamites* is given at p. 381, defining the basis, in the special characters, for each group.

The palæozoic genus *Sphenophyllum* is defined as showing some points of contact with various living plants; but it is a nearly isolated type among the Pteridophytes of the Coal-measures. The anatomy of its stem, root, leaves, and cone is fairly well known, and the details are here carefully illustrated, together with remarks on the affinities, range, and habit of the genus.

The careful list of works referred to in the text fills 26 pages, and the excellent index (12 pages) completes this Vol. I. of a most valuable work, conscientiously and cautiously elaborated. With regard to the researches of others, whether botanists with more or less interest in geology, or geologists often with but little real botanical knowledge, the author is honestly critical, modest in the expression of his own opinions, and courteous in his disapproval, or, when necessary, in his rejection, of the views or statements of others.